

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

UNDERGROUND OUTLET

(feet)
CODE 620

DEFINITION

A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

PURPOSE

Dispose of excess water from terraces, diversions, subsurface drains, surface drains, trickle tubes or principal spillways from dams (outside the dam area only), or other concentrations without causing damage by erosion or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Excess surface water needs to be disposed of.
- A buried outlet is needed for **Diversion** (Code 362), **Terrace** (Code 600), or similar practices.
- An underground outlet can be installed that will safely dispose of excess water.
- Surface outlets are impractical because of stability problems, climatic conditions, land use, or equipment traffic.

Scope

*This standard applies to underground conduits designed to dispose of excess surface water. It does not apply to trickle tubes or to principal spillways in ponds or in **Subsurface Drain** (Code 606).*

CRITERIA

Capacity

The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace, diversion, or other practices function according to the standard for the specific practice. For example, an underground outlet can be used in combination with a grassed waterway or a surface drain to carry part of the design flow. The capacity of the underground outlet for natural or constructed basins shall be adequate for the intended purpose without causing excessive damage to crops, vegetation, or improvements.

Storage Basins

Storage basins may be terraces, diversions, water and sediment control basins, or natural depressions. Storage volume shall equal or exceed the volume obtained by routing the required frequency storm through the inlet and conduit line. The minimum storage volume and discharge for practices designed with a 10-year frequency storm will be obtained from curves shown in the Hawaii Supplement to the Engineering Field Handbook (EFH), Part 650, Chapter 8. The maximum discharge capacity used to compute storage requirement shall be 450 gpm/acre.

Consideration should be given to providing emergency outlets once the basin fills to design capacity. Emergency outlets may be grassed fields, grassed swales, road ditches and terrace segments with low fill

heights. In no case will overflows be permitted to overtop the storage basin near the inlet location. Emergency outlets are to minimize damage to the system for storms greater than design frequency but will not be used to reduce required storage.

Inlet

An inlet can be a collection box, a perforated riser, or other appropriate device. Its capacity shall be adequate to provide the maximum design flow in the conduit. Flow-control devices shall be installed as necessary. Perforated risers must be of durable material, structurally sound, and resistant to damage by rodents or other animals. If burning of vegetation is likely to create a fire hazard, the inlet shall be fire resistant. Blind inlets can be used where they are effective. Collection boxes must be large enough to facilitate maintenance and cleaning operations. The inlet must have an appropriate trash guard to insure that trash or other debris entering the inlet passes through the conduit without plugging. It must also have an animal guard to prevent the entry of rodents or other animals.

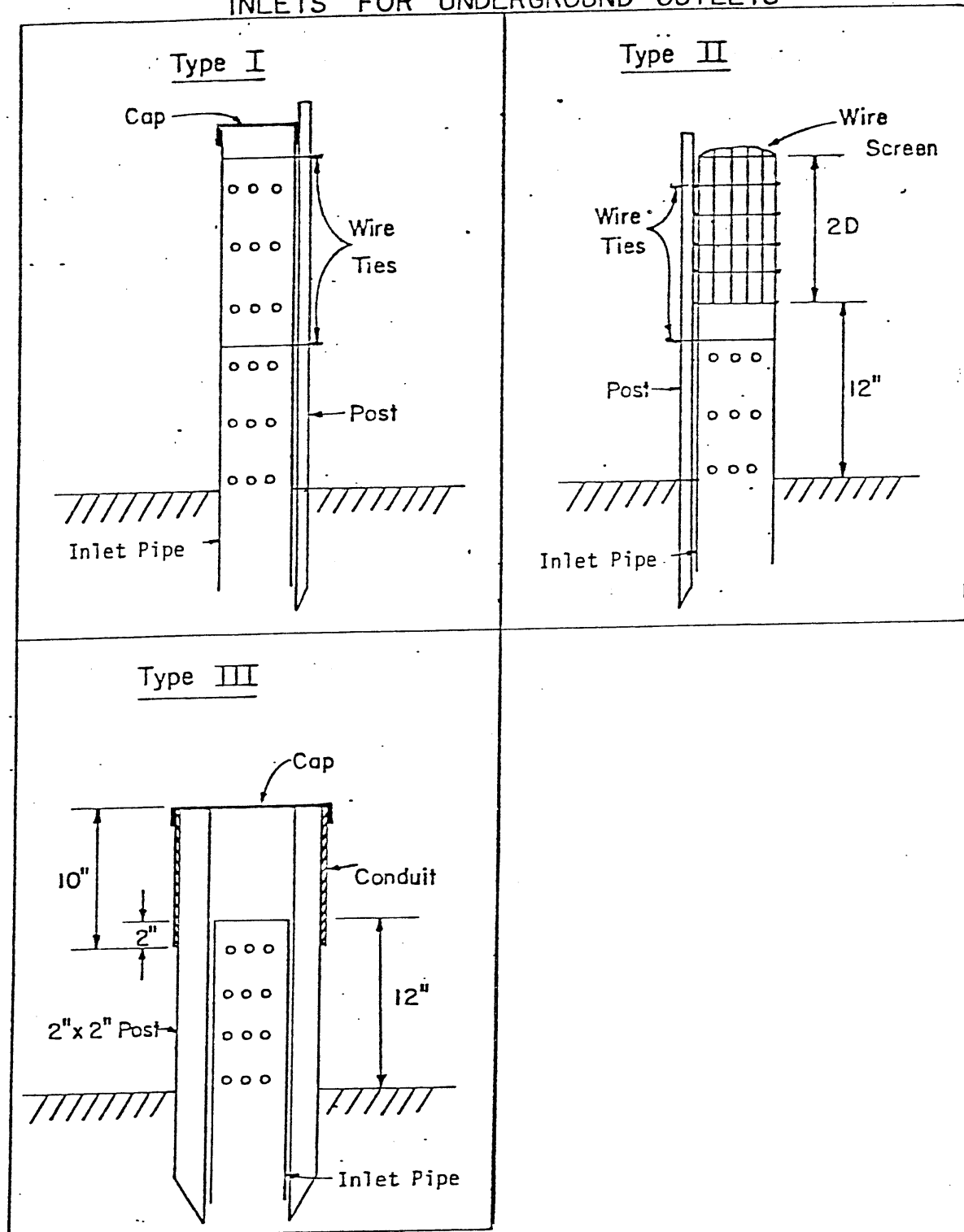
Pressure-relief wells shall be designed and installed as needed to control pressure. If

junction boxes and other structures are needed, they shall be designed and installed in a manner that facilitates cleaning and other maintenance activities.

Inlets may be Type I, II or III as shown on Figure 1. Maximum size of intake holes in inlets shall be 1 inch in diameter except that they may be rectangular in shape providing they are no wider than 3/4 inch. Minimum area of the opening between the inlet pipe and the cover for Type III inlets shall be 1.5 times the inside area of the inlet pipe. All intake openings shall be smooth and burr free. Inlets shall have sufficient capacity to operate at design discharge at one-half (1/2) the ridge or basin height. Table 1 in the Hawaii Supplement to the EFH, Part 650, Chapter 8, can be used to select an adequate inlet. All pipe inlets shall be covered with a durable cap or screen. Caps or screens shall be removable on inlets with orifice plates. Type II inlet will not be used with orifice plates unless screen size is reduced to 3/4" X 1".

Orifice plates, when used, shall fit tightly against the seat and have a smooth edge. Use exhibit 8-5, EFH, Part 650, Chapter 8, to determine capacity of orifice plates.

INLETS FOR UNDERGROUND OUTLETS



Hydraulics

Underground outlets shall be continuous conduits, tubing, or tile. Joints shall be hydraulically smooth, and the materials and methods used shall be recommended by the manufacturer. If a pressure system is used, joints shall be adequate to withstand the design pressure, including surges and vacuum. The maximum velocity must not exceed the safe velocity for the conduit materials and installation.

Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Positive grade shall be maintained in all sections of an underground outlet.

Capacity shall be based on the pipe size or on other flow control devices to prevent water from the upper inlets from discharging through the lower inlets. *Conduit line capacity shall be determined using an "n" value of 0.015 for corrugated plastic tubing and smooth iron pipe and 0.025 for corrugated metal pipe and a "c" value of 150 for PVC.* The minimum conduit diameter shall be 3 inches.

Materials

Materials shall meet or exceed the design requirements against leakage and shall withstand internal pressure or vacuum and external loading. Plastic, concrete, aluminum, and steel shall meet the requirements specified in the applicable ASTM standard. All materials specified for **Subsurface Drain** (Code 606) can be used for underground outlets. Conduits, however, can be perforated or nonperforated, depending on the design requirements. A filter fabric wrap (sock) or equivalent shall be used if migration of soil particles around conduit is anticipated. All exposed plastic materials shall be protected from degradation due to exposure to sunlight.

Outlet

The outlet shall be sufficiently stable for all anticipated flow conditions. It shall be designed for the maximum anticipated water surface at design flow. A continuous section of closed conduit or a headwall can be used at the outlet. If a closed conduit is used, it shall be durable and strong enough to withstand all anticipated loads. Outlets shall not be placed in areas of active erosion. If fire is a hazard, the outlet shall be fire resistant. All outlets must have animal guards to prevent the entry of rodents or other animals. Animal guards must be hinged to allow passage of debris.

Protection

All disturbed areas shall be reshaped and regraded so that they blend with the surrounding land features and conditions. Visual resources must be given the same consideration as other design features. Areas that are not to be farmed or covered by structural works shall be established to vegetation or otherwise protected from erosion as soon as practicable after construction.

CONSIDERATIONS

Consider effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

Consider effects on the volume of downstream flow that might cause undesirable environmental, social, or economic effects.

Evaluate potential use for water management.

Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by runoff.

Consider effects on the visual quality of downstream water resources.

Consider the construction-related effects on the quality of downstream watercourses.

Consider effects on wetlands or water-related wildlife habitats.

Evaluate potential impact on water quality due to agri-chemicals in outflow.

Consider depth of underground outlet in regard to tillage equipment depth and maintenance, if applicable.

PLANS AND SPECIFICATIONS

Plans and specifications for installing underground outlets shall be in keeping with this standard and shall describe the requirements for installing the practice to achieve its intended purpose.

Plans shall include location of inlet and outlet line, storage depth, inlet capacity, inlet type, inlet riser size, number and size of intake holes, orifice plate size (if used), outlet line size, outlet line grade, and type of materials for inlet and outlet line. Plans for underground outlets may be incorporated in the plans for the practice that it is to serve.

OPERATION AND MAINTENANCE

Underground outlets shall be maintained by:

- Keeping inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce the flow
- Repairing leaks and broken or crushed lines to insure proper functioning of the conduit
- Checking outlet conduit and animal guards to ensure proper functioning of the conduit
- Keeping adequate backfill over the conduit
- Repairing any eroded areas at the pipe outlet